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Abstract

LONG TERM DEVELOPMENTS IN IRRADIATED NATURAL URANIUM PROCESSING COSTS

OPTIMAL SIZE AND SITING OF PLANTS

by MM. L. THIRIET - C.E.A.
C. OGER - Saint-Gobain Nucléaire
P. De VAUMAS - Saint-Gobain Nucléaire

(Commissariat à l'Energie Atomique, France)

The aim of this paper is to help solve the problem of the selection of optimal sizes and sites for spent nuclear fuel processing plants associated with power capacity programmes already installed.

Firstly, the structure of capital and running costs of irradiated natural uranium processing plants is studied, as well as the influence of plant sizes on these costs and structures. Shipping costs from the production site to the plant must also be added to processing costs. An attempt to reach a minimum cost for the production of a country or a group of countries must therefore take into account both the size and the location of the plants. The foreseeable shipping costs and their structure (freight, insurance, container cost and depreciation), for spent natural uranium are indicated.

Secondly, for various annual spent fuel reprocessing programmes, the optimal sizes and locations of the plants are determined. The sensitivity of the results to the basic assumptions relative to processing costs, shipping costs, the starting up year of the plant programme and the length of period considered, is also tested.

- this rather complex problem of a combinative nature, is solved through dynamic programming methods.

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- It is shown that these methods can also be applied to the problem of selecting the optimal sizes and locations of processing plants for M T R type fuel elements, related to research reactor programmes, as well as to future plutonium element processing plants related to breeder reactors.

Thirdly, the case where yearly extraction of the plutonium contained in the irradiated natural uranium is not compulsory is examined ; some stockpiling of the fuel is then allowed some years, entailing delayed processing. The load factor of such plants is thus greatly improved with respect to that of plants where the annual plutonium demand is strictly satisfied. By including spent natural uranium stockpiling costs an optimal rythm of introduction and optimal sizes for spent fuel processing plants are shown, different from those in part two.

The indirect effect of these reprocessing programmes on the availability of plutonium, and therefore on the possibility of undertaking plutonium burning reactor programmes, must be taken into account.